Assignment 1

AI1110: Probability and Random Variables
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12.13.6.13: Question. Assume that the chances of a patient having a heart attack is 40%. It is also assumed that a meditation and yoga course reduce the risk of heart attack by 30% and prescription of certain drug reduces its chances by 25%. At a time a patient can choose any one of the two options with equal probabilities. It is given that after going through one of the two options the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga?

Answer: $\frac{14}{29}$.

Solution: According to the given question: the chances of heart attack is 40%.

According to the question:

A:	Person with heart attack	$\Pr(A)$=0.40
E_1:	Person treated with meditation and yoga	$\Pr(E_1)$=0.50
E_2:	Person treated with drug	$\Pr(E_2)$=0.50

Table 1: Given Information

Here, we are supposed to find the probability of a person getting a heart attack and is followed with meditation and yoga. i.e. $\Pr(E_1|A)$

$$\Pr(E_1|A) = \frac{\Pr(E_1)\Pr(A|E_1)}{\sum_{i=1}^{2}\Pr(E_i)\Pr(A|E_i)} \tag{1}$$

Now we have to find $\Pr(A|E_1)$ and $\Pr(A|E_2)$.

$\Pr(A|E_1)$ = Probability that a person getting a heart attack after being treated with meditation and yoga.

Meditation and yoga reduces the risk of a heart attack by 30%. There is still a 70% chance of heart attack.

$$\Pr(A|E_1) = \Pr(A)(1-(0.30)) \tag{2}$$

$$\Pr(A|E_1) = 0.40 \times 0.70 = 0.28 \tag{3}$$

$\Pr(A|E_2)$ = Probability that a person getting a heart attack after being treated with drug.

Drug reduces the risk of a heart attack by 25%. There is still a 75% chance of heart attack.

$$\Pr(A|E_2) = \Pr(A)(1-(0.25)) \tag{4}$$

$$\Pr(A|E_2) = 0.40 \times 0.75 = 0.30 \tag{5}$$

Using (1),(3) and (5)

$$\Pr(E_1|A) = \frac{\Pr(E_1)\Pr(A|E_1)}{\sum_{i=1}^{2}\Pr(E_i)\Pr(A|E_i)} \tag{6}$$

$$= \frac{\frac{1}{2}\times 0.28}{\frac{1}{2}\times 0.28 + \frac{1}{2}\times 0.30} = \frac{0.28}{0.28+0.30} = \frac{0.28}{0.58} = \frac{14}{29} \tag{7}$$